-+*9 Zagazig University Faculty Of Engineering Industrial Engineering Dept.		3rd Year Industrial Eng. Simulation Sheet (1)

1) In a grocery store, the historical record on the demand of a specific item is as follows:-

Demand Level	Frequency (days)
1	10
2	15
3	30
4	10
5	20
6	40

1. Calculate probability for each level.
   Prob=Freq/∑Freq
2. Calculate Cumulative probability.
3. Set Random number Interval.
4. Generate Random numbers and define the corresponding level.
5. Calculate The Expected Demand Level

Using simulation, Determine the expected demand level.

				Random Number Interval	
Demand Level	Freq (days)	Probability	Cum. probability	Start	End
1	10	0.08	0.08	0	0.08
2	15	0.12	0.2	0.08	0.2
3	30	0.24	0.44	0.2	0.44
4	10	0.08	0.52	0.44	0.52
5	20	0.16	0.68	0.52	0.68
6	40	0.32	1	0.68	1
	125	1			

Runs	R.n	Demand Level
1	0.16	2
2	0.61	5
3	0.60	5
4	0.40	3
5	0.39	3
6	0.65	5
7	0.62	5
8	0.73	6
9	0.05	1
10	0.74	6
		41

Expected Demand Level = ∑ (Demand Level) / no. of Runs = 41 / 10 = 4.1

2) In a large restaurant, the demand on the meals during a 15 hrs is as follows :-

Time	**8-9 AM**	**9-10 AM**	**10-11 AM**	**11-12 AM**	**12-1 PM**	**1-2 PM**	**2-3 PM**	**3-4 PM**
Meals record	**0**	**3**	**10**	**20**	**30**	**50**	**100**	**100**
Time	4-5 PM	5-6 PM	6-7 PM	7-8 PM	8-9 PM	9-10 PM	10-11 PM	
Meals record	**50**	**50**	**80**	**80**	**70**	**50**	**40**	

Using simulation, Determine the expected demand level.

				Random Number Interval	
Meals record	**Frequency**	**Probability**	**Cumulative probability**	**Start**	**End**
0	1	0.07	0.07	0	0.07
3	1	0.07	0.13	0.07	0.13
10	1	0.07	0.20	0.13	0.20
20	1	0.07	0.27	0.20	0.27
30	1	0.07	0.33	0.27	0.33
40	1	0.07	0.40	0.33	0.40
50	4	0.27	0.67	0.40	0.67
70	1	0.07	0.73	0.67	0.73
80	2	0.13	0.87	0.73	0.87
100	2	0.13	1.00	0.87	1.00
	15	1			

Runs	**R.n**	**Demand Level**
1	0.09	3
2	0.87	80
3	0.55	50
4	0.85	80
5	0.26	20
6	0.49	50
7	0.38	40
8	0.06	0
9	0.85	80
10	0.13	10
		413

Expected Demand Level = ∑ (Demand Level) / no. of Runs = 413 / 10 = 43.1 = 44

3) In Emergency department in a hospital, the number of patients of a specific shift is as follows :-

Working hr	1	2	3	4	5	6	7	8
# patients	5	3	4	2	1	7	6	7

If the crew size depends on the number of patients per hour.

Crew size	5	4	3	2
# patients/hr	7	6	5	4

Determine the Crew size of that shift.

				Random Number Interval	
# patients	Frequency	Probability	Cumulative probability	Start	End
1	1	0.13	0.13	0	0.13
2	1	0.13	0.25	0.13	0.25
3	1	0.13	0.38	0.25	0.38
4	1	0.13	0.50	0.38	0.50
5	1	0.13	0.63	0.50	0.63
6	1	0.13	0.75	0.63	0.75
7	2	0.25	1.00	0.75	1.00
	8	1			

Runs	R.n	# patients	# Crew
1	0.91	7	5
2	0.34	3	2
3	0.66	6	4
4	0.92	7	5
5	0.30	3	2
6	0.16	2	2
7	0.72	6	4
8	0.96	7	5
9	0.32	3	2
10	0.87	7	5
			36

4) While planning the maintenance of a facility, the breakdown time and repair time is as follows:-

Breakdown time (hr)	10	11	12	13	14	15	16
Frequency	1	5	7	10	11	13	14
Repair time	1	3	5	7	9	12	15

Simulate the actual operation of breakdown and repair.

				Random Number Interval	
Breakdown time (hr)	Frequency	Probability	Cumulative probability	Start	End
10	1	0.02	0.02	0	0.02
11	5	0.08	0.10	0.02	0.10
12	7	0.11	0.21	0.10	0.21
13	10	0.16	0.38	0.21	0.38
14	11	0.18	0.56	0.38	0.56
15	13	0.21	0.77	0.56	0.77
16	14	0.23	1.00	0.77	1.00
	61	1.00			

Runs	R.N	Breakdown time (hr)
1	0.95	16
2	0.29	13
3	0.41	14
4	0.02	10
5	0.65	15
6	0.35	13
7	0.51	14
8	0.74	15
9	0.91	16
10	0.42	14

				Maintenance of a facility			
Runs	Breakdown time (hr)	Cumulative	Repair Time	Start	End	Idle	Wait
1	16	0	15	0	15	16	0
2	13	13	7	15	22	0	2
3	14	27	9	27	36	5	0
4	10	37	1	37	38	1	0
5	15	52	12	52	64	14	0
6	13	65	7	65	72	1	0
7	14	79	9	79	88	7	0
8	15	94	12	94	106	6	0
9	16	110	15	110	125	4	0
10	14	124	9	125	134	0	1